MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

EEN4206 – SEMICONDUCTOR PACKAGING AND TEST

(ME/RE/TE)

28 OCTOBER 2017
9.00 a.m - 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 3 pages with 4 Questions only.

2. Attempt **ALL (4)** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a)(i) Describe the IC Packaging. [2 marks]

(ii) What are the three central modern society challenges that Infineon solution addresses? What are the system solutions Infineon offers? [3 × 2 marks]

(b)(i) Who are the consistent top two semiconductors leaders over the past 3 years? Where does Infineon rank in year 2017? [2 + 1 marks]

(ii) How many pieces of IC growth is expected in 2017? [2 marks]

(iii) Where is the origin of Moore's Law? [3 marks]

(c)(i) Define the junction temperature, T_j. [2 marks]

(ii) What limits the maximum T_j? What are the effects if the temperature is over the rated specification? [3 marks]

(iii) In the limitation described in part (ii), what are the other solution / media that can significantly improve maximum T_j today? [2 marks]

(d) For the case of Tin Whisker by Toyota, what would you have done differently if you were the designer of the IC product? [2 marks]

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Question 2

(a) List the five primaries die attach technology mainly adopted by semiconductor industries and each of its process condition. [5 marks]

(b) Explain the following factors that affect the process variation in wire bonding:

(i) Method
(ii) Machine
(iii) Material
(iv) Man
(v) Enviroment [5 × 2 marks]

(c)(i) What are the four primary considerations for a capillary? Give a brief explanation. [4 marks]

(ii) Specify three key capillary dimensions that affecting ball bond. [3 marks]

(iii) Specify three key capillary dimensions that affecting stitch bond. [3 marks]

Question 3

(a) When characterizing a measurement process, what are the five measurement systems to be considered? [5 marks]

(b) Describe the five critical factors that influence the performance of the measurement system. [5 marks]

(c) Explain the terms of (i) repeatability, (ii) reproducibility and (iii) stability in measurement system. [3 × 2 marks]

(d)(i) What is the advantage of Dynamic Part Average Test (PAT) compare to Static PAT? [2 marks]

(ii) Describe how Dynamic PAT limit practices upon completing test. [3 marks]

(iii) What is the basic criteria to enable Dynamic PAT in actual implementation? [2 marks]

(iv) Write the formula to calculate the Dynamic PAT. [2 marks]

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Question 4

(a)(i) Give a sample preparation method used to expose Cu wire. [3 marks]

(ii) What are the common electrical failures can be derived from the I-V characteristic during electrical testing? [4 marks]

(b)(i) What are the common thin film contaminations on a bond pad in a semiconductor? [3 marks]

(ii) Give two common techniques used to investigate the thin film contamination on a bond pad. [2 marks]

(c)(i) If current density of HTOL at 125°C is 3×10^5 A/cm^2 and the normal operating condition at 50°C is 2×10^5 A/cm^2. Calculate the acceleration factor by current, where $n = 2$ and assume that $J >> J_{critical}$. [4 marks]

(ii) If the total acceleration factor by current acceleration and temperature acceleration is AF(J, T) = 4380 and the stress duration = 1000 hours, estimate lifetime of the device at use condition. [4 marks]

(d) Assuming the Arrhenius-model is used to express the thermal acceleration of semiconductor device failure mechanism, show that the equation of activation energy is

$$E_a = \frac{k(\ln t_2 - \ln t_1)}{(\frac{1}{T_2} - \frac{1}{T_1})}$$

where k is Boltzmann's constant, t_1 and t_2 are time to failure under stress temperature T_1 (high temperature) and temperature T_2 (low temperature) respectively. [5 marks]

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